

FAO ANIMAL PRODUCTION AND HEALTH



guidelines

BREEDING STRATEGIES FOR SUSTAINABLE MANAGEMENT OF ANIMAL GENETIC RESOURCES

COMMISSION ON
GENETIC RESOURCES
FOR FOOD AND
AGRICULTURE



BREEDING STRATEGIES FOR
SUSTAINABLE MANAGEMENT OF
ANIMAL GENETIC RESOURCES

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Foreword

Animal genetic resources for food and agriculture comprise an essential component of the biological basis for world food security. Hundreds of millions of poor rural people keep livestock and often rely on their animals to provide multiple products and services. In harsh environments where crops will not flourish, livestock keeping is often the main or only livelihood option available. Livestock currently contribute about 30 percent of agricultural gross domestic product in developing countries, with a projected increase to about 40 percent by 2030. The World Bank has estimated that it will be necessary to increase meat production by about 80 percent between 2000 and 2030. This will require more efficient animal production systems, careful husbandry of natural resources and measures to reduce waste and environmental pollution.

The State of the World's Animal Genetic Resources for Food and Agriculture provides for the first time a comprehensive country-driven global assessment of the roles, values and status of animal genetic resources. It clearly shows that the full potential of animal genetic resources is not being realized and that an urgent global response is needed to improve the use and development of these resources and to address their current rapid erosion. The *Global Plan of Action for Animal Genetic Resources*, adopted by the International Technical Conference on Animal Genetic Resources for Food and Agriculture held in Interlaken, Switzerland, in September 2007, and subsequently endorsed by all FAO member countries, sets out concrete measures to address these needs.

The *Global Plan of Action* contains four Strategic Priorities Areas, which provide a basis for enhancing sustainable use, development and conservation of animal genetic resources throughout the world. Its implementation will contribute significantly to achieving Millennium Development Goals 1 (eradicate extreme poverty and hunger) and 7 (ensure environmental sustainability). The Interlaken Conference called on FAO to continue developing technical guidelines and assistance and to continue coordinating training programmes as a means to support countries in their efforts to implement the *Global Plan of Action*.

The objectives of these guidelines on *Breeding strategies for sustainable management of animal genetic resources* are to help countries plan and develop effective genetic improvement programmes and to maximize the chances that such programmes will be sustained. The guidelines are intended for use by policy-makers and organizations involved in livestock development. They provide countries with advice on how to:

- specify their objectives and priorities;
- identify the conditions necessary for sustainable development of their animal genetic resources;
- benefit from the experiences of other countries with similar conditions; and
- find practical guidance on how to initiate or improve breed development programmes.

The preparation of the guidelines was initiated in accordance with the recommendation made by the Intergovernmental Technical Working Group on Animal Genetic Resources for

Food and Agriculture at its Second Session in September 2000 that approaches, procedures and tools be developed to assist countries with the planning, implementation and further development of genetic improvement programmes and policies that are directed at promoting sustainable development and food security. The guidelines were discussed and validated at a series of workshops. In total, 120 scientists, technicians and policy-makers from all regions contributed to the process.

The guidelines will be refined and updated periodically as experience with their use in the field is accumulated. The assistance of the National Coordinators for the Management of Animal Genetic Resources and their country networks will be particularly important to this process of revision.

Acknowledgements

The preparation of the guidelines was initiated by Keith Hammond, formerly FAO Senior Officer for Animal Genetic Resources. Some of the sections were reviewed and rewritten by John Woolliams, Salah Galal and Joaquin Mueller, who were involved in the preparation process from the very beginning. The guidelines were reviewed, tested, validated and finalized at workshops held in France, India, Kenya, the United Republic of Tanzania, Peru and Italy. These workshops, attended by 120 scientists, technicians and decision-makers, were organized in collaboration with Vincent Ducrocq, Suresh Gokhale, Okeyo Mwai, Sachindra Das and Gustavo Gutiérrez, respectively. Case studies presented in the guidelines were prepared by Ben Kubbinga and Marie-Louise Beerling. Marie-Louise Beerling and Regina Laub addressed gender issues. Barbara Hall contributed to the copyediting.

The guidelines were prepared under the supervision of Badi Besbes, with the full support of the Chief of FAO's Animal Production Service, Irene Hoffmann, and of current and former officers of the Animal Genetic Resources Group: Paul Boettcher, Beate Scherf, Dafydd Pilling, Mitsuhiro Inamura, Manuel Luque Cuesta, Frank Siewerdt and Olaf Thieme. Administrative and secretarial support was provided by Kafia Fassi-Fihri and Carmen Hopmans.

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Executive summary

These guidelines – *Breeding strategies for sustainable use of animal genetic resources* – are part of a series of publications prepared by FAO to support countries in the implementation of the *Global Plan of Action for Animal Genetic Resources*. The specific objective is to assist countries to plan and develop effective genetic improvement programmes and to maximize the chances that these programmes will be sustained. The guidelines are intended to help countries to specify and prioritize their objectives; identify the conditions necessary for the sustainable development of their animal genetic resources for food and agriculture (AnGR); benefit from the experiences of other countries with similar conditions; and find practical guidance on how to initiate or improve breed improvement programmes.

The guidelines aim to address policy, operational and technical issues, and how these inter-play to shape the outcomes of breeding strategies. Policy-makers and organizations involved in livestock development are the principal target audience of the guidelines, which adopt a broad scope as a means to avoid atomizing the topic and presenting policy, operational or technical matters in an unconnected way to different groups of users. A comprehensive approach is necessary because the lessons learned from livestock breeding in practice demonstrate that activities must be coordinated and integrated in time and space in order to achieve clarity in direction and efficiency of operation and that the whole process must be underpinned by a sound understanding of the technical issues.

The initial sections of the guidelines take a national or regional perspective. Later sections become progressively more targeted towards breeding organizations and those responsible for implementing specific breeding schemes – both cross-breeding and straight-breeding. Each section outlines a set of tasks that needs to be carried out in order to achieve the desired outcome. These tasks are further broken down into a series of actions. In every section, a participatory approach is promoted wherever feasible, and gender issues are identified. A common thread throughout all sections is the need to document plans and decisions.

SECTION A. FORMING THE WORKING GROUP FOR PREPARING ANIMAL BREEDING STRATEGIES

Developing a successful breeding strategy first requires assembling a committed working group of individuals who recognize the potential importance of the work. In turn, the working group must be able to mobilize a range of stakeholders to become involved in the process. National and regional governments will normally be among the key stakeholders, particularly in developing countries. This section offers guidance on identifying the stakeholders who will be important to the development and implementation of the strategy. The working group needs to draw up a working plan that assigns responsibilities and establishes time scales for the planning process.

SECTION B. IDENTIFYING LIVESTOCK DEVELOPMENT OBJECTIVES AND STRATEGIES

A breeding strategy is implemented with the objective of creating genetic change in the livestock population in order to benefit livestock keepers and wider groups of stakeholders. Such benefits will be realized only if the desired changes are consistent with other trends affecting the livestock production systems targeted and if the resources are available to deliver the planned improvements. This section, therefore, looks beyond breeding to address livestock development as a whole, with the objective of providing guidance on identifying realistic development objectives for countries' livestock production systems and identifying development strategies appropriate to meeting these objectives. A substantial body of information will need to be sought out, collated and scrutinized. This will include information on government policies and legal instruments that affect livestock production (including how they promote or inhibit development strategies); the country's major production systems (human development objectives that need to be addressed, the capacity and motivation of farmers to participate in development strategies and the environmental sustainability of the production systems); and historical and predicted future trends for each production system (i.e. social, market and environmental trends – including the effects of climate change).

Guidance is offered on how the information assembled may be used to identify clear livestock development objectives and sustainable development strategies. The strategy identified as being appropriate for a particular production system may or may not include a breeding component. It is suggested that a series of workshops be held in order to achieve the objectives described in this section. Guidance is also offered regarding the range of expertise that may be needed to complete this element of the planning process.

SECTION C. MATCHING ANIMAL GENETIC RESOURCES WITH PRODUCTION SYSTEMS TO ACHIEVE LIVESTOCK DEVELOPMENT OBJECTIVES

AnGR can be used in various ways to achieve livestock development objectives. Strategies may be based on the use of locally available breeds, introduced breeds, or both. The breeds chosen may provide the basis for straight- or cross-breeding schemes. It is essential to ensure that the AnGR used are well matched to the production systems in which they will be kept, taking account of the development objectives and planned development strategies for these systems. Evidence gathered in the last 10 to 15 years has yielded ample evidence that in many cases local breeds provide a good fit to these needs; in such cases a decision to use a locally available breed will be appropriate. Conversely, in some cases there may be a *prima facie* case for introducing an exotic breed. Experience shows, however, that such introductions will only be successful if there is clear evidence that a substantial benefit is achievable *within* the production system and that local stakeholders will accept the introduction. It is recommended that such an introduction be considered only if there is evidence that it will give rise to benefits in excess of 30 percent because introducing exotic breeds involves many risks and requires careful planning and rigorous breed evaluation, which is costly and challenging.

Step-by-step guidance on the process of identifying appropriate breeds for a production system is offered. Emphasis is given to the need to seek evidence that goes beyond simplistic production figures drawn from the use of exotic breeds in exotic production systems. If, following careful consideration, a breed is to be introduced, it is recommended that

a germplasm introduction plan be developed, and this plan should include conservation actions for local breeds that may be affected by the introduction.

SECTION D. DEVELOPING STRAIGHT-BREEDING PROGRAMMES

This section provides guidance on the development of straight-breeding schemes (i.e. schemes based on selection within a specific breed). It is split into three phases: the first two are relevant to schemes at inception and during early development; the third is relevant to later development. Phase I is concerned with establishing detailed breeding goals and the associated goal trait values (measures of relative importance, such as economic value). The approach taken to Phase I is subjective and participatory. Phase II is initiated by identifying current breeding practices and market structure and by seeking ways of promoting community involvement before proceeding to develop and document a standard operating procedure for a breeding nucleus. Clear recommendations are offered on the division of responsibilities for the various procedures involved (genetic, veterinary, financial, etc.). The plan for the straight-breeding scheme, once it is developed, will provide a basis for securing funding. The advice offered on the implementation of Phase III includes a number of measures that may speed progress, facilitate dissemination or promote the sustainability of the scheme.

SECTION E. DEVELOPING CROSS-BREEDING PROGRAMMES

Cross-breeding is an alternative means of generating genetic change in a population. It may be implemented in various forms including sustained cross-breeding (in which all breeds contributing the cross also have to be maintained as straight-bred populations), the development of a new synthetic breed, or breed substitution carried out by recurrent crossing. In the latter two cases, the cross-breeding programme will evolve into a straight-breeding programme. A cross-breeding programme can be a complex operation that needs efficient organization and possibly the stratification of the animal population into multitier breeding structures. Guidance is offered on the specification of breeding goals, the assessment of current breeding practices, and the development of a plan that will provide the basis for obtaining funding, implementation and further development of the scheme. Where sustained crossing is envisaged, particular emphasis is given to ensuring that the dissemination of the improved germplasm is feasible with the available technology and infrastructure.

SECTION F. EVALUATING INVESTMENT DECISIONS

This section presents guidance on the conduct of an investment appraisal for a breeding strategy as a whole or for a particular breeding scheme. A classical economic approach is adopted, which includes identifying the appropriate level of appraisal (national, sectoral, community or household), whether the appraisal is retrospective or prospective, and the planning horizons and discount factors to be used. Although it is suggested that the appraisal calculate costs and returns for each group of stakeholders (livestock keepers, breeders, retailers, government, etc.), this may not always be possible. It is also suggested that consideration be given to non-monetary values that cannot easily be included in economic analyses, but will often play a critical role in determining the wisdom of the investment. Factors to consider include gender issues, food and livelihood security, the wider impacts of improved nutrition and hard-to-quantify household and other services provided by livestock.

Preparation of the guidelines

BACKGROUND

Livestock (including poultry) make an essential contribution to food and agriculture and rural development. The products and services they provide include meat, milk, eggs, fibre, draught power and manure for fertilizer and fuel. They make important contributions to livestock keepers' abilities to manage risk and help maintain social networks within the community. The importance of livestock is increasing as human population growth, rising incomes and urbanization in developing countries fuel a massive increase in demand for foods of animal origin. The projected increase in demand is expected to drive major changes in the livestock sector during the period to 2020, a process that has been termed "the livestock revolution".

Animal genetic resources for food and agriculture (AnGR) provide the biological capital on which livestock production systems and food security are built. Planning for sustainable livestock development should, from the outset, take account of genetic differences among the species, the breeds and the animals considered for use, along with their adaptive fitness to the production environments in which they will be kept. The different ways in which animals are used in different production systems and communities should also be recognized.

The State of the World's Animal Genetic Resources for Food and Agriculture (FAO, 2007) indicates that the vast majority of developing countries have not been successful in sustaining genetic improvement in their livestock populations. Among the breeds considered to be in active use, 77 percent are located in developing countries. The livestock keepers in these countries certainly have breeding goals and exploit local knowledge and technologies to pursue them, but 94 percent of breeds are not subject to structured genetic improvement programmes. Therefore, many countries are failing to take advantage of the opportunities that such programmes offer to develop animals that better meet the needs of livestock-keeping communities and supply the products that consumers demand. Conversely, the majority (77 percent) of breeds subject to structured genetic improvement programmes are located in developed countries.

Sustained livestock genetic improvement activities that meet national needs without jeopardizing community needs can make a vital contribution to food security and rural development. Lessons learned from countries that have initiated and sustained genetic improvement activity during the past half-century provide a solid basis for the effective use of animal genetic diversity. The results are impressive, especially those achieved in developed countries, where the productivity of breeds subjected to genetic improvement has been doubled or tripled. Around half of this gain has resulted from genetic improvement activity and the other half from a range of non-genetic interventions. The significance of these achievements is further underlined by the fact that most of the genetic improvement is comparatively permanent. The benefits of investments in genetic improvement are recouped year after year by livestock keepers and communities. Genetic improvement activity in developed-country production systems has now become, perhaps without exception, a

fundamental and integral element of the ongoing process of improving productivity as a means to maintain profits, use input resources more efficiently and improve product quality, food safety and animal health. There is, however, a need to recognize that improved management should accompany genetic improvement, as higher-producing animals have greater requirements in terms of feeding and husbandry.

LESSONS LEARNED

It is important to understand why developing countries generally have not been successful in sustaining structured genetic improvement activities. For several decades, it was widely held that developed countries could best assist developing countries to improve their AnGR by introducing highly selected breeds and establishing them as straight-bred or cross-bred populations to substitute for the local ones. Experience has shown that such strategies have serious limitations. They are effective only where the developing country's production systems are already able to provide the introduced breeds with levels of inputs similar to those provided in their countries of origin. If this is not the case, the introduced breeds and their crosses are often exposed to intense stressors to which they are not well adapted (e.g. periodic feed and water shortages, diseases, climatic extremes and lower-capacity husbandry). Development strategies have also failed because the associated extension and communications focused on technical issues and only on men, neglecting the wider production system and women's roles in animal management (see Box 1).

Reproduction rates among the introduced breeds or crosses often also have been poorer than those of the locally adapted breeds. Even more importantly, the survival rates of the introduced animals frequently have been low. Poor survival rates are a major concern because, in lower-input production systems, animal longevity is essential to productivity and efficient use of resources. The introduction, crossing and diffusion of exotic genetic resources in developing countries have often been well advanced before negative effects have been reported.

It is essential that the process of identifying the AnGR from which livestock keepers and communities are likely to derive the most benefit take account of differences among production systems. This applies to production-system differences within an individual country as well as to those between developing- and developed-country production systems. For example, the type of chicken required for poultry production systems that have access to market infrastructure is different from the type that contributes best to sustaining the livelihoods of the poorest in areas where there is no reliable market infrastructure or means to purchase inputs. In the latter situation, the chickens must have the abilities to scavenge for feed and to nest and brood so that they can reproduce without assistance as well as a resistance or tolerance to a range of diseases and parasites.

Just as importantly, full consideration must be given to all the uses to which livestock keepers put their animals. Livestock in low- to medium-input production systems are commonly kept for multiple purposes, while production in high-input systems focuses on one (or at most two) primary output(s). Consequently, genetic improvement strategies in the latter type of system emphasize combinations of traits that would not be appropriate for many developing-country production systems. When AnGR developed under the higher-input, lower-stress production systems are introduced to developing countries, they frequently do not prove to be much better than the locally adapted AnGR, particularly in terms of life-cycle

efficiency. Country strategies may therefore need to focus on developing genetic resources that are already well adapted to the local production systems and to livestock keepers' goals. Such AnGR will either have been developed locally or may be sourced from similar production environments elsewhere.

To move forward in the development of AnGR, it is essential to avoid repeating past mistakes and to build on lessons learned. In the vast majority of developing countries very few or no genetic improvement programmes are currently being sustained. What are the reasons for this? Have few programmes been initiated, or have those that have been initiated in recent decades not been sustained? Reliable data are difficult to obtain because the parties involved are frequently unwilling to report negative results.

BOX 1

Dairy development in Kenya – recognizing women's roles

In 1979 the Extension Service in Kenya initiated the National Dairy Development Project, which targeted smallholder farmers and involved setting up milk collection centres. The system was designed to deal with a steadily increasing volume of milk. But this did not materialize. When the quantity of milk delivered to the collection centres dropped to uneconomic levels, it was time for a critical review. A woman dairy production expert who had attended a gender course was put in charge. A questionnaire-based survey was designed. The enumerators consisted of extension agents, and the sample population included both women and men.

The key to the extension effort was "zero-grazing" – the cross-bred dairy cows, because of their greater vulnerability and higher management requirements, had to be kept in a shed and stall-fed with Napier grass. Cows of this type need close inspection for parasites and diseases, and have to be milked twice a day. This was something new to the farmers. To familiarize them with the new system, the Extension Service offered them training and follow-up, which focused almost exclusively on men. Three-day training courses were organized in central locations, rather than in villages, which made it difficult for women to attend. When extension agents visited farms they usually asked, "Is the Mzee in?" (the "boss", the man of the household); if he was not, they would turn and leave. Therefore, women were not involved in the new developments.

Yet women formed an essential part of these projects. They were expected to clean the cowsheds and take the cows to the dip tank for antitick treatment. They milked the cows, and usually took the milk to the collection centre. But at the end of the month, when the men received the cash, many spent most of it rather than keeping it to buy new school uniforms for the children or pay for medical treatment or other necessities.

The study revealed a high level of dissatisfaction among women, who felt that their role in dairy farming had been entirely overlooked and their inputs unrewarded. They used their only means of protest: doing less than their best. This explained most of the decrease in milk production.

Sources: Reynolds, Metz and Kiptarus (1996), Mullins (2005).

The Food and Agriculture Organization of the United Nations (FAO) has examined the above questions by commissioning a broad range of case studies (ICAR/FAO, 2000a) and by hosting several meetings of technical experts and e-conferences. The results of these investigations suggest that, relative to the number of breeds in active use, far fewer genetic improvement programmes have been initiated in developing than in developed countries (China, and to a lesser extent Brazil and India, may be exceptions to this pattern). Moreover, many breeding activities initiated in developing countries have not been sustained. The reasons for the general lack of successful breeding programmes in developing countries can be summarized as follows:

- Many countries do not have the technical and operational capacities fully to evaluate the range of available AnGR, the production environments in which they may be put to use and the strategies and options for their development.
- Countries have often adopted policies that favour particular approaches to genetic improvement (e.g. introducing AnGR from developed countries) without fully assessing their long-term implications.
- Livestock keepers have not been involved adequately in the early planning and development of genetic improvement programmes to which they have been expected to contribute and from which they have been expected to benefit. This has resulted in a failure to ensure that the products of the programmes – the improved animals – meet the livestock keepers' needs without exceeding their capacity to manage the animals or to obtain the necessary external inputs.
- Genetic improvement programmes have been undertaken without detailed documentation of the operational plans. As a result, only a few livestock keepers, field technicians and/or policy-makers have clearly understood the intended objective of the development strategy and what was to be done, by whom and when.
- Genetic improvement activities have often been initiated through short-term projects. Conversely, experience from advanced livestock genetic improvement programmes, particularly in developed countries, has shown that long-term, evolving strategies involving the public and private sectors can be highly successful.

A STRATEGIC APPROACH TO SUSTAINABLE GENETIC IMPROVEMENT

A strategic and logistical approach to sustainable livestock development is required. To appropriately address the use of available AnGR and the role of genetic improvement in sustainable development, from the outset all policies, plans and programmes for the livestock sector must:

- be based on soundly established and agreed livestock development objectives (LDOs) and well-integrated and realistic livestock development strategies (LDS) that are able to achieve the LDOs;
- account for major environmental, structural and socio-economic differences among the production systems concerned;
- ensure participation of the end users (the livestock keepers themselves). Both men and women should have access to relevant information, be involved in the formulation of policies and plans and have ample opportunities to give their opinions;
- be appropriately funded;
- promote step-by-step development and the sustainability of the actions undertaken;

- be based on well-documented approaches that are understood and agreed by all the stakeholders involved at each stage; and
- take fully into account the fundamental principles of genetic improvement and their technical implications.

These guidelines on *Breeding strategies for sustainable management of animal genetic resources* have been developed based on this strategic approach in order to assist countries to develop and implement their livestock genetic improvement programmes more effectively and to help them to maximize the sustainability of these programmes.

DEVELOPMENT OF THE GUIDELINES

The idea of developing these guidelines emerged in September 2000 when the Intergovernmental Technical Working Group on Animal Genetic Resources for Food and Agriculture recognized that genetic improvement of breeds must form an integral part of sustainable livestock development. The working group also recommended the development of approaches, procedures and tools for countries to use in planning, implementing and further developing genetic improvement programmes and policies directed at promoting sustainable development and food security. Further impetus was generated in September 2007 when the International Technical Conference on Animal Genetic Resources for Food and Agriculture, held in Interlaken, Switzerland, requested FAO (among others) to continue developing technical guidelines in order to assist countries in the implementation of the newly adopted *Global Plan of Action for Animal Genetic Resources*.

Following considerable research and interaction with a broad spectrum of scientists and technicians, who have experience in both developing and developed countries and a good understanding of a range of species and production systems, FAO considered it technically feasible to develop guidelines for animal breeding strategies. A broad-based working group of experts was convened to discuss and critically evaluate the approach to be taken.

The experts recommended the development of guidelines that would be simple to use and comprehensive in their coverage of genetic options and major animal species and that would help decision-makers avoid the recurrence of past causes of failure. They also provided a set of recommendations for completing the development and field testing of the guidelines prior to general release.

It was deliberately decided to focus on classical breeding options based on quantitative genetics, which have demonstrated their efficiency and are relatively easy and affordable to implement, and not to consider new technologies based on molecular genetics (gene-based selection or marker-assisted selection). The newer technologies are not yet used routinely, even by breeding companies in the developed world; they remain costly and require expertise and infrastructure that developing countries generally lack.

The draft guidelines were discussed and evaluated at six workshops, which were held in France (September 2006), India (November 2006), Kenya (March 2007), the United Republic of Tanzania (March 2008), Peru (March 2008) and Italy (July 2008). The evaluations allowed gaps and weaknesses to be identified so that the necessary amendments could be made.

User guidance

WHAT IS THE PURPOSE OF THESE GUIDELINES?

The guidelines have been prepared to assist with the planning and implementation of livestock breeding strategies. More specifically they:

- describe the prerequisites for developing AnGR;
- take the user through a step-by-step decision-making process, which leads to the formulation of a breeding strategy;
- explain how to plan and implement breeding programmes, technically and operationally;
- describe the need for theoretical and local knowledge to be integrated in order to plan the development of AnGR;
- describe the need for thorough discussion with community-level stakeholders – not just livestock owners, but also keepers, managers, herders and caretakers; and
- provide information on the possible time frame in which the planned activities should achieve measurable results.

UNDER WHAT CONDITIONS SHOULD THE GUIDELINES BE USED?

The guidelines have been designed for countries or organizations that wish to develop AnGR through breeding programmes but have limited experience and a limited number of qualified staff. It is assumed that the guidelines will be used in situations where:

- a developed infrastructure for breed development is not in place, thus precluding direct adaptation of approaches from more developed situations; and
- policies and strategies for livestock development exist. The guidelines are intended to complement them with regard to breed development.

WHAT IS THE TARGET GROUP?

The guidelines are intended for use by all persons and organizations interested and involved in planning and implementing breed development activities, particularly officials of national and regional governments, research institutions, non-governmental organizations (NGOs) and private institutions. Knowledge of the principles of animal genetics and breeding will be an advantage for using the guidelines, but is not essential.

HOW ARE THE GUIDELINES STRUCTURED?

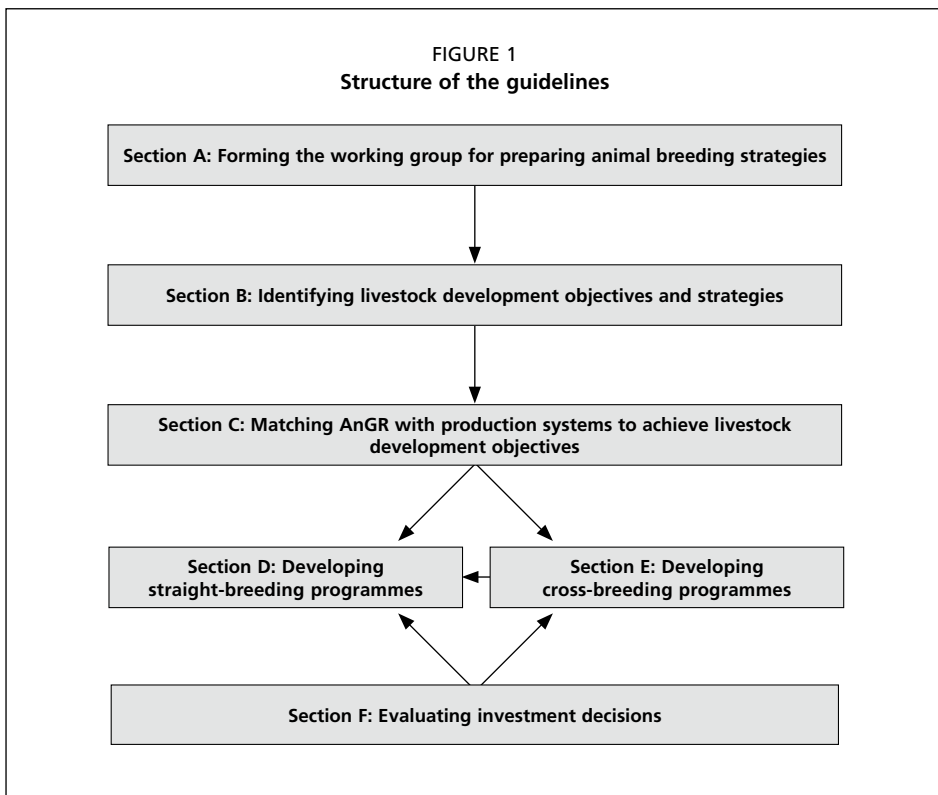
The guidelines are divided into a number of sections (Figure 1) that address the following objectives and tasks:

- forming a working group to take charge of establishing the genetic improvement strategy (Section A);
- identifying development objectives for the livestock sector in general and for the species and production systems under consideration (Section B);
- defining the ways in which breeding can contribute to meeting the objectives (Section B);

- deciding what “breed improvement” means: i.e. what the user wishes to achieve and for which breed(s) (Section C);
- deciding how to achieve the breed improvement (Sections D and E);
- estimating the costs involved (Section F); and
- internalizing the conditions required for achieving success in breed improvement (all sections).

Each section is introduced by a description of its rationale and objective(s). This is followed by a description of the inputs needed (and, where relevant, advice on locating potential sources), a description of desired outputs and a list of the tasks that need to be undertaken in order to achieve these outputs.

Users are provided with a set of questions they can use to judge the relevance of the topic of the section to their particular situation and how the subject matter may be approached. Answering these questions may require that users seek information from other sources. The guidelines outline the options available and discuss the likely consequences of different decisions. Ultimately, however, decisions have to be taken by the users themselves. If the breeding strategy is to be formulated by a working group, the topics described in each section will be discussed among the group. Once the working group has completed the activities described in each section, it will prepare a written statement that sets out its specific decision(s). Working through all relevant sections of the guidelines will lead users towards a breeding strategy for a specific breed in a specific production system.



HOW SHOULD THE GUIDELINES BE USED?

Formulating policies and strategies for the development of AnGR is teamwork. It might be undertaken by the National Consultative Committee that was established for the preparation of the country reports on AnGR submitted during the preparation of *The State of the World's Animal Genetic Resources for Food and Agriculture* or by a committee formed specifically for the purpose. The guidelines are intended to structure the working approach of such a committee, but can also be used by any interested individual for study purposes or to support decision-making. The sections of the guidelines are arranged in a logical sequence. It is suggested that users follow this sequence, but they have the option of bypassing sections and going directly to those that they consider most relevant.

Development of AnGR is only one component of livestock development. Policies and strategies for other components, such as animal health, feed resources and marketing and other services, have to be taken into consideration when developing the breeding strategy.

Several workshops will be needed to formulate a policy and decide on a strategy. For each workshop, background material should be available to participants in advance. This material should include reports on the outcomes of any previous workshops and on the results of wider consultations held with stakeholders who were not present at the workshops.

ARE THESE GUIDELINES ONLY FOR THOSE WHO ARE DEVELOPING NEW BREEDING PROGRAMMES?

No, they can also be used to assess and strengthen ongoing breeding programmes.